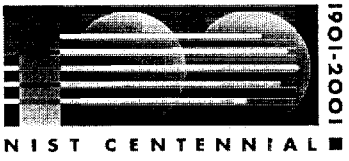
*** EACH PAPER IS TREATED LIKE ***
A SEPARATE DOCUMENT AND MAYBE
VIEWED AND/OR DOWNLOADED THAT WAY

NISTIR 6588

FIFTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY MARCH 1-7, 2000

VOLUME 1

Sheilda L. Bryner, Editor



National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

NISTIR 6588

FIFTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY MARCH 1-7, 2000

VOLUME 1

Sheilda L. Bryner, Editor

November 2000

U. S. Department of Commerce
Norman Y. Mineta, Secretary
Technology Administration
Dr. Cheryl L. Shavers, Under Secretary of Commerce for Technology
National Institute of Standards and Technology
Raymond G. Kammer, Director

CONTENTS
VOLUME 1

MATERIALS PERFORMANCE AND TESTING

PEOPLE AND FIRE

PERFORMANCE-BASED CODES AND STANDARDS

FIRE SUPPRESSION

CONTENTS
VOLUME 2

OPEN TECHNICAL PAPERS

EMMONS MEMORIAM
Symposium in Memory of Professor Howard Emmons

INTRODUCTION

The 15th meeting of the U.S.-Japan Panel on Fire Research and Safety was held at the Southwest Research Institute in San Antonio Texas, March 1-7, 2000. Approximately 60 experts on fire science and fire safety engineering participated in the sessions. The core of the meeting consisted of technical sessions on materials performance and testing, people and fire, performance-based codes and standards, and fire suppression.

In addition, the meeting hosted a one-day Symposium in memory of Professor Howard W. Emmons of Harvard University who passed away on November 20, 1998. Professor Emmons was the father of modern fire science in the United States and had been an enthusiastic participant in these UJNR meetings. This was a celebratory event, with excellent technical papers, fond memories, and renewed friendships.

Among the technical sessions, the participants found time to visit the laboratories of the Southwest Research Institute and Omega Point Laboratories. The Saturday between sessions included a tour of the Johnson Space Flight Center in Houston and a re-enactment of the battle of the Alamo on its 164th anniversary. These provided further opportunity for the new participants in this venerable bi-national conference to spend time with those with extensive experience, and for the veterans to strengthen the fellowship of the international fire research community. Plans are now underway for a sequence of specialist workshops to be held in the years to come.

Agenda

Fifteenth Joint Panel Meeting of the
U.S. - Japan Panel on Fire Research and Safety

March 1-7, 2000
San Antonio, Texas

Wednesday, March 1, 2000 *(Opening ceremony and single technical session)*

8:30 Opening Ceremony: Jack Snell, Chair (NIST/BFRL)

9:30 Group Photo

Materials Performance and Testing

9:50 Ichiroh Nakaya (BRI): **"Japanese Progress and Overview of Building Material Performance and Testing"**

10:05 Takashi Kashiwagi (NIST/BFRL): **"Material Performance and Testing, U.S. Overview"**

10:20 Break

10:40 Masashi Yoshida (BRI): **"International Round Robin Testing With ISO 5660 Cone Calorimeter"**

11:00 Marc L. Janssens (SwRI): **"Balanced Approach to the Fire Performance Evaluation of Interior Finish Materials"**

11:20 Yuji Hasemi (Waseda Univ.) or Hayashi (BRI): **"Interpretation Of Small And Intermediate Scale Fire Testing"**

11:40 James G. Quintiere (U. MD): **"Formulas for Fire Growth Phenomena Based on Materials Properties"**

12:00 Lunch

1:00 Takashi Kashiwagi, Kathryn M. Butler, Jeffrey W. Gilman (NIST/BFRL): **"Fire Safe Materials Project at NIST"**

1:20 Thomas J. Ohlemiller (NIST/BFRL): **"Influence of Polymer Melt Behavior in Flammability"**

1:40 Tokiyoshi Yamada (NRIFD): **"Flammability Test for Flame Retardant Plastic Pallet"**

2:00 Richard E. Lyon (FAA): **"Heat Release Kinetics"**

2:20 Arthur F. Grand (Omega Point): **"A Study of the Effectiveness of Fire Resistant Durable Agents on Residential Siding Using the ICAL Apparatus"**

2:40 BREAK

3:00 Tour of SwRI Facilities

6:30 Welcome Reception – Menger

Thursday, March 2, 2000

People and Fire

9:00 John R. Hall (NFPA): **"Overview of Research on People and Fire in the U.S".**

9:15 Manabu Ebihara (Shimizu): **"Progress and Overview of Study on Evacuation Safety and Fire Risk Assessment in Japan"**

9:30 Richard G. Gann (NIST/BFRL): **"A Research Program to Determine When and How to Include Sublethal Effects of Smoke in Fire Safety Decisions"**

9:50 Yoshiro Yashiro (Shimizu): **"Fire Safety Design and Fire Risk Analysis in Consideration of Fire Progress Stage"**

10:10 Break

10:40 Ai Sekizawa (NRIFD): **"Development of Seismic-induced Fire Risk Assessment Method for a Building"**

11:00 Rita F. Fahy (NFPA): **"New Developments in EXIT89"**

11:20 Ichiro Hagiwara (BRI): **"Evaluation Method of Egress Safety"**

11:40 Lunch

Open Technical Session I

1:00 Takeyoshi Tanaka (Kyoto Univ.): **"Preliminary Model For Urban Fire Spread - Building Fire Behavior Under The Influence Of External Heat And Wind"**

1:20 Ken Matsuyama (Sci. Univ. Tokyo): **"Systematic Experiments Of Room And Corridor Smoke Filling For Use In Calibration Of Zone And CFD Fire Models"**

1:40 Koji Hayashi and Yoshihiko Kagiya (BRI): **"Research Project on Disaster Prevention in Town Planning"**

2:00 Morgan J. Hurley (SFPE): **"A Research Agenda for Fire Protection Engineering"**

2:20 Osami Sugawa (Sci. Univ. Tokyo): **"Flow Behavior Under Sloped Ceiling"**

2:40 BREAK

3:30 Depart for Omega Point Laboratories

4:00 Tour and dinner at Omega Point Laboratories

Friday, March 3, 2000

Performance-based Codes and Standards

9:15 Shuitsu Yusa (BRI) and Makoto Tsujimoto (Nagoya Univ.): **"Progress and Overview of Performance-based Codes and Standards in Japan"**

9:30 Craig Beyler (Hughes): **"Developments in PBD Technical Infrastructure: SFPE Engineering Design Guide and Engineering Practice Guides"**

9:50 Shuitsu Yusa (BRI): **"Outline of Reforming the Building Standard Law in Japan"**

10:10 BREAK

10:40 Yoshifumi Ohimya (BRI): **"Evaluation Method of Structural Fire Resistance"**

11:00 Takeyoshi Tanaka (Kyoto Univ.): **"A Risk-based Translation of Fire Resistance Requirement"**

11:20 Richard W. Bukowski (NIST/BFRL): **"Development of a Hazard-based Methods for Evaluating the Fire Safety of Passenger Trains"**

11:40 Naohiro Takeichi (BRI): **"Approach to Efficient System of Building Control"**

12:00 Lunch

Fire Suppression

1:00 Richard G. Gann (NIST/BFRL): **"Fire Suppression Research in the United States: An Overview"**

1:15 Naoshi Saito (NRIFD): **"Overview on Progress of Fire Extinguishing Research and Technology in Japan"**

1:30 William M. Pitts and Linda G. Blevins (NIST/BFRL): **"An Investigation of Extinguishment by Thermal Agents Using Detailed Chemical Kinetic Modeling of Opposed Jet Diffusion Flames"**

1:50 Anthony Hamins and Matthew Bundy (NIST/BFRL): **"Suppression of Low Strain Rate Flames by an Agent"**

2:10 T. Tsuruda (NRIFD) and D. Makarov (All-Russian RIFP): **"Numerical Modelling of Fire and Gaseous Fire Suppression"**

2:30 BREAK

3:00 Yoshio Ogawa (NRIFD): **"Fire Extinguishing Effect of Water Vapor"**

3:20 Masahiro Morita (Sci. Univ. Tokyo): **"Suppression Mechanism of Water Mist for Pool Fire"**

3:40 David T. Sheppard, Pravinray D. Gandhi (UL), and Richard M. Lueptow (NW Univ): **"Understanding Sprinkler Sprays: Trajectory Analysis"**

4:00 Hsiang-Cheng Kung (FM): **"Development of the Residential Sprinklers and Issues Highlighted by Recent Research"**

4:20 S. Noguchi, S. Ookubo (Yokohama R&D, Mitsubishi), and M. Miyasaka: **"Development of Pneumatic Atomizing Gun for Fire Fighting"**

Dinner on own

Saturday, March 4, 2000

Technical Outing - Johnson Space Flight Center (Houston)

Sunday, March 5, 2000

Free Day

Monday, March 6, 2000

Symposium in Memory of Professor Howard Emmons

9:00 Reminiscences

9:30 John L. de Ris (FM): **"Experiments Establishing the Similarity of Wall Fire Combustion"**

10:10 Takeyoshi Tanaka (Kyoto Univ.): **"Necessity of Design Methodology in the Framework of a Performance-Based Fire Safety Design System"**

10:50 BREAK

11:20 David D. Evans (NIST/BFRL): **"Use of Fire Simulation in Fire Safety Engineering and Fire Investigation"**

12:00 Lunch

Symposium in Memory of Professor Howard Emmons

1:00 Howard R. Baum (NIST/BFRL): **"A Convective Heat Transfer Model for Large Eddy Fire Simulations"**

1:40 Masahiro Morita (Sci. Univ. Tokyo): **"Mathematical Model for Fire Phenomenon"**

2:20 Craig Beyler (Hughes): **"Modeling Fire Growth in Room/Corner Configurations"**

3:00 BREAK

3:20 Arvind Atreya and David Everest (Univ. Michigan)**: "Simultaneous Measurements of Drop Size and Velocity in Large-Scale Sprinkler Flows Using Laser-Induced Fluorescence"**

4:00 Yugi Hasemi (Waseda Univ.), Masashi Yoshida (BRI), and Ryosuke Takaike (NCC): **"Flame Length and Flame Heat Transfer Correlations in Ceiling Fires"**

4:40 Osami Sugawa (Sci. Univ Tokyo): **"Behavior of Flame/Plume Flow in and near Corner Fire - Entrainment Coefficient for Corner Fire"**

6:30 Symposium Banquet

Tuesday, March 7, 2000

Open Technical Session II

9:00 Steven T. Bushby (NIST/BFRL): **"Integrating Fire Systems with Other Building Automation and Control Systems"**

9:20 William L. Grosshandler (NIST/BFRL): **"Multi-function Sensing for Cybernetic Building Systems"**

9:40 Hiroshi Hayasaka (Hokkaido Univ.): **"Forest Fires in Boreal Forest - the Alaska Taiga"**

10:00 Patrick J. Pagni (Berkeley): **"Fire Spread by Brand Spotting"**

10:20 BREAK

10:50 Kazunori Harada (Kyoto Univ.): **"Revision of Zone Fire Model BRI2 for New Evaluation System"**

11:10 Long T. Phan (NIST/BFRL): **"Heating, Spalling Characteristics Residual Properties of High Performance Concrete"**

11:30 Tomohiro Naruse (BRI), Hasemi (Waseda Univ.): **"Wind Effect on Fire Behavior in Compartment"**

11:50 Lunch

Open Technical Session III

1:00 Yusaku Iwata (NRIFD), Hiroshi Koseki, and Marc Janssens(SwRI): **"Comparison of Combustion Characteristics of Crude oils using Cone Calorimeter"**

1:20 William M. Pitts and George W. Mulholland (NIST/BFRL): **"Improved Real-Scale Fire Measurements Having Meaningful Uncertainty Limits"**

1:40 Closing Session

LIST OF MEMBERS (JAPAN)

Who attended the 15th UJNR meeting

Dr. Hiroharu Habu (Japan Chairman)
Director General
Building Research Institute

Dr. Asamichi Kamei (Japan Vice-Chairman)
Director General
National Research Institute of Fire and Disaster

Dr. Ichiro Hagiwara (BRI Coordinator)
Head, Fire Safety Division
Building Research Institute

Dr. Ai Sekizawa (NRIFD Coordinator)
Chief, Third Research Division
National Research Institute of Fire and Disaster

Dr. Shuitsu Yusa
Associate Director for Fire Research
Building Research Institute

Dr. Ichiro Nakaya
Head, Fire Preventive Materials Division
Building Research Institute

Dr. Yoshihiko Hayashi
Head, Smoke Control Division
Building Research Institute

Dr. Tomohiro Naruse
Chief Researcher,
Evaluation System Division
Building Research Institute

Dr. Yoshifumi Ohmiya
Researcher,
Fire Preventive Materials Division
Building Research Institute

Mr. Masashi Yoshida
Chief Researcher, Fire Safety Division
Building Research Institute

Dr. Koji Kagiya
Researcher, Smoke Control Division
Building Research Institute

Mr. Naohiro Takeichi
Guest Researcher, Fire Safety Division
Building Research Institute

Dr. Naoshi Saito
Chief, Second Research Division
National Research Institute of Fire and Disaster

Dr. Tokiyoshi Yamada
Head, Special Fire Section
National Research Institute of Fire and Disaster

Dr. Takashi Tsuruda
Head, Second Extinguishing Section
National Research Institute of Fire and Disaster

Mr. Yoshio Ogawa
Research Staff, Second Extinguishing Section
National Research Institute of Fire and Disaster

Mr. Yusaku Iwata
Research Staff, Hazardous Materials Section
National Research Institute of Fire and Disaster

Prof. Yuji Hasemi
Department of Architecture
Waseda University

Prof. Makoto Tsujimoto
Department of Geotechnical &
Environmental Engineering
Nagoya University

Prof. Takeyoshi Tanaka
Disaster Prevention Research Institute
Kyoto University

Prof. Kazunori Harada
Department of Architecture
Kyoto University

Mr. Daisaku Nii
Student
Kyoto University

Mr. Keisuke Himoto
Student
Kyoto University

Prof. Masahiro Morita
Department of Applied Mathematics
Science University of Tokyo

Prof. Osami Sugawa
Research Institute for Science and
Technology
Science University of Tokyo

Mr. Ken Matsuyama
Assistant, Department of Architecture
Science University of Tokyo

Prof. Hiroshi Hayasaka
Department of Urban and Environmental
Engineering, Hokkaido University

Prof. Kenji Satoh
Department of Physics
Toho University

Dr. Yoshiro Yashiro
General Manager, Social Science
Department, Institute of Technology
Shimizu Corporation

Mr. Manabu Ebihara
Research Staff, Izumi Research Institute
Shimizu Corporation

Mr. Shintarou Noguchi
Research Staff, Yokohama Research &
Development Center
Mitsubishi Heavy Industries

LIST OF MEMBERS (U.S.)

Panel Members:

Dr. Jack Snell (U.S. Chairman)
Director, Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. Richard Gann (U.S. Coordinator)
Senior Research Scientist
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. Takashi Kashiwagi (U.S. Secretary)
Materials Fire Research Group
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. Ronald Alpert
Materials Research
Factory Mutual Research, Affiliate of FM Global

Dr. Howard Baum
Fire Dynamics Group
Fire Safety Engineering Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. Craig Beyler
Technical Director
Hughes Associates, Inc.

Dr. David Evans
Chief, Fire Safety Engineering Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. William Grosshandler
Chief, Fire Science Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. John R. Hall, Jr.
Assistant Vice President
Fire Analysis and Research
National Fire Protection Association

Dr. Anthony Hamins
Leader, Large Fire Research Group
Fire Safety Engineering Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. Marc Janssens
Manager, Materials Flammability Section
Department of Fire Technology
Division of Chemistry and Chemical Engineering
Southwest Research Institute

Prof. Patrick Pagni
Department of Mechanical Engineering
University of California-Berkeley

Prof. James Quintiere
Department of Fire Protection Engineering
University of Maryland

Associate Members

Prof. Arvind Atreya
Department of Mechanical Engineering and Applied Mechanics
University of Michigan

Mr. Richard Bukowski
Leader, Fire Safety Systems Group
Fire Safety Engineering Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Mr. Steven Bushby
Leader, Mechanical Systems and Controls Group
Building Environment Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. John de Ris
Materials Research
Factory Mutual Research, Affiliate of FM Global

Dr. Arthur Grand
Director of Research
Omega Point Laboratories

Dr. Rita Fahy
Fire Analysis and Research Division
National Fire Protection Association

Dr. Hsiang-Cheng Kung
Director, Fire Protection Research
Factory Mutual Research, Affiliate of FM Global

Dr. Richard Lyon
Manager, Fire Research Program
Fire Safety Section
Federal Aviation Administration Technical Center

Dr. Long Phan
Structures Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Dr. William Pitts
Leader, Advanced Fire Measurements Group
Fire Science Division
Building and Fire Research Laboratory
National Institute of Standards and Technology

Mr. David Sheppard
Large Scale Fire Research
Underwriters Laboratories, Inc.

15th Meeting of the U.JNR Panel on Fire Research and Safety
March 1-7, 2000
San Antonio, Texas
Session Chairs

Time	Session	U.S.	Japan
Wed; 3/1 a.m.	Opening	Snell	
Wed; 3/1 a.m.	Materials Performance and Testing I	Kashiwagi	
Wed; 3/1 p.m.	Materials Performance and Testing II		Nakaya
Thurs; 3/2 a.m.	People and Fire	Hall	Sekizawa
Thurs; 3/2 p.m.	Open Technical I	Hamins	Hagiwara
Fri; 3/3 a.m.	Performance-based Codes and Standards	Bukowski	Yusa
Fri; 3/3 p.m.	Fire Suppression	Alpert	Saito
Mon; 3/6 a.m.	Emmons Symposium I	Baum	
Mon; 3/6 p.m.	Emmons Symposium II		Hasemi
Tues; 3/7 a.m.	Open Technical II	Beyler	
Tues; 3/7 p.m.	Open Technical III		Yamada
Tues; 3/7 p.m.	Closing		Kamei
	Resolutions	Gann, Pagni	Saito, Sekizawa, Yusa, Hagiwara

RESOLUTIONS

March 7, 2000

RESOLUTIONS

The members of the United States-Japan Conference on Development of Natural Resources? Panel on Fire Research and Safety are pleased with the results of the 15th Joint Panel Meeting, held in San Antonio, Texas on March 1-7, 2000. We wish to thank the staff of the Department of Fire Technology of the Southwest Research Institute for their hospitality and the National Fire Protection Association, Underwriters Laboratories, Factory Mutual Research, and Omega Point Laboratories for their support.

This Panel continues to facilitate the exchange of important research ideas between two of the world's leading fire research communities. We are pleased to have been able to gather at this meeting some of the best minds in fire research and safety from both the United States and Japan.

The following resolutions summarize the consensus for the future:

It is hereby resolved that:

1. The objectives of the meetings of this Panel are to :

   a. Exchange particularly interesting technical information regarding our latest research, and
   b. Promote cooperative research on focused areas within fire safety science.

2. Because of the emergence of such meetings as the International Symposia on Fire Safety Science, IAFSS sectional meetings, and Interflam, the future focus of the UJNR Panel will be on small, specialist meetings on topics of strong mutual interest. Possible topics could include: quantitative test methods for fire safety design, performance-based fire codes and design, fires after earthquakes, fire detection, fire suppression, wind effects on fire, fire modeling, fire physics, fire chemistry, fire measurements, burning behavior of furnishings or interior finish, large-scale tests, behavior of people in fires, firefighter safety technologies, and risk and hazard analysis.

   The specific subject matter and timing of these UJNR workshops will be selected in two ways:

   a. Technical experts from the two countries may arrange such workshops among themselves.
   b. The leaders of the fire research programs at NIST, BRI and NRIFD will meet annually to identify topics of mutual interest.

The University of Kyoto has offered to host the first of these workshops in the fall of 2001. Candidate topics, each with a statement of purpose and draft list of participants, should be distributed in both countries by October 1, 2000.

3. To facilitate communications between meetings, NIST, BRI and NRIFD will increase their efforts to share publications in a timely manner. This will include posting publications on our respective web sites, sending publications to the other country by e-mail or post, and updating "UJNR Fire Research and Safety News."

4. Due to financial and organizational circumstances, there has been less United States-Japan joint research in recent years. The Panel encourages resumption of such highly productive interactions. We particularly recommend extended visits by young researchers to each others' laboratories. Topics and collaborators for such projects will be presented to the leaders of the fire research programs at NIST, BRI and NRIFD by October 1, 2000.

INDEX

AUTHOR INDEX
VOLUMES 1 and 2